

SCH3U-Master Formula Sheet

MRS. NEMAN

| Important Constants | | |
|--|--|--|
| Avagadro's Number (N _A)= 6.02 × 10 ²³ particles | | |
| 1atm = 760 torr =101.3kPa= 760mm Hg=14.7 PSI | | |
| Universal Gas Constant (R)= 8.314 kPa•L/mol•K | | |
| 0°C = 273.125 K T(K)=T(°C) + 273.15 | | |
| (STP) 101.325kPa 0°C= 273K | | |
| (SATP) 100.0kPa 25°C =298K | | |
| Molar Volume of gas (STP) (V _{mol})22.4 L/mol | | |
| Molar Volume of gas (SATP) (V _{mol})=22.4 L/mol | | |
| me= 9.11 x 10 ⁻³¹ kg | | |
| m _p =m _n = 1.67 x 10 ⁻²⁷ kg | | |

Quantities in Chemical Reactions and Solutions

$$\text{Molar Volume (L/mol)} = \frac{V}{n} \quad \frac{n_1}{V_1} = \frac{n_2}{V_2}$$

$$n = cV \quad c_1V_1 = c_2V_2 \quad \text{density (g/L)} = \frac{\text{mass (g)}}{\text{volume (L)}}$$

$$\% \text{ yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$$

$$\text{ppm} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 10^6 \quad \text{ppb} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 10^9$$

$$m / m \% (g) \text{ or } v / v \% (ml) = \frac{\text{quantity of solute}}{\text{quantity of solution}} \times 100$$

Acids/Base Chemistry

$$[H^+] = 10^{-pH} \quad pH = -\log[H^+]$$

Gas Laws

$$PV=nRT \quad P_{\text{total}} = P_1 + P_2 + \dots$$

$$P_{\text{total}} = P_{\text{hydrogen}} + P_{\text{water vapour}}$$

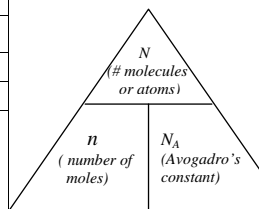
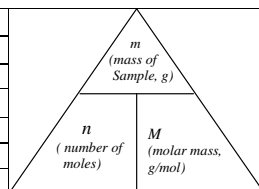
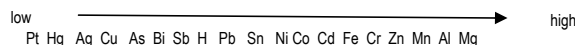
$$P_{\text{gas}} = P_{\text{total}} \times n_{\text{gas}} / n_{\text{total}}$$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \quad P = \frac{F}{A} \quad n_{\text{gas}} = \frac{V}{22.4 \text{ mol/L}} \quad V_{\infty} \frac{T}{P}$$

Activity Series: Metals & Non-Metals

-Metals from Li to Na will replace H from acids and water

-Metals from Mg to Pb will replace H from acids only

**Multivalent ions**

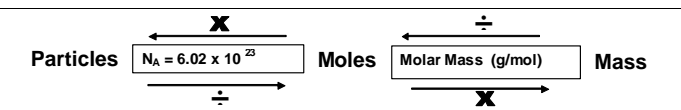
| | Valence |
|-----------|---------|
| Antimony | 3+, 5+ |
| Arsenic | 3+, 5+ |
| Bismuth | 3+, 5+ |
| Cadmium | 2+ |
| Chromium | 2+, 3+ |
| Cobalt | 2+, 3+ |
| Copper | 1+, 2+ |
| Gold | 1+, 3+ |
| Iron | 2+, 3+ |
| Lead | 2+, 4+ |
| Manganese | 2+, 4+ |
| Mercury | 1+, 2+ |
| Nickel | 2+, 3+ |
| Platinum | 2+, 4+ |
| Silver | 1+ |
| Tin | 2+, 4+ |
| Titanium | 3+ |
| Zinc | 2+ |

Diatomic Elements:

H₂, O₂, F₂, Br₂, I₂, N₂, Cl₂

Polyatomic Elements:

S₈, P₄

**Common Polyatomic Ions**

| Polyatomic Name | Formula | Oxyacid |
|-----------------|--|--------------|
| Ammonium | NH ₄ ⁺ | |
| Acetate | C ₂ H ₃ O ₂ ⁻ | Acetic |
| Bicarbonate | HCO ₃ ⁻ | |
| Bromate | BrO ₃ ⁻ | Bromic |
| Hypochlorite | ClO ⁻ | Hypochlorous |
| Chlorite | ClO ₂ ⁻ | Chlorous |
| Chlorate | ClO ₃ ⁻ | Chloric |
| Perchlorate | ClO ₄ ⁻ | Perchloric |
| Cyanide | CN ⁻ | |
| Hydroxide | OH ⁻ | |
| Iodate | IO ₃ ⁻ | Iodic |
| Nitrite | NO ₂ ⁻ | Nitrous |
| Nitrate | NO ₃ ⁻ | Nitric |
| Permanganate | MnO ₄ ⁻ | |
| Carbonate | CO ₃ ²⁻ | Carbonic |
| Chromate | CrO ₄ ²⁻ | Chromic |
| Dichromate | Cr ₂ O ₇ ²⁻ | Dichromic |
| Oxalate | C ₂ O ₄ ²⁻ | Oxalic |
| Sulfite | SO ₃ ²⁻ | Sulfurous |
| Sulfate | SO ₄ ²⁻ | Sulfuric |
| Thiosulfate | S ₂ O ₃ ²⁻ | Thiosulfuric |
| Tartrate | C ₄ H ₄ O ₆ ²⁻ | Tartric |
| Citrate | C ₆ H ₅ O ₇ ³⁻ | Citric |
| Phosphite | PO ₃ ³⁻ | Phosphorous |
| Phosphate | PO ₄ ³⁻ | Phosphoric |

Solubility Chart of Common Compounds (25°C, 1 atm)

s: soluble, i: insoluble, p slightly soluble, d: decomposes, -: does not exist

| | acetate C ₂ H ₃ O ₂ ⁻ | bromide Br ⁻ | carbonate CO ₃ ²⁻ | chlorate ClO ₃ ⁻ | chloride Cl ⁻ | hydroxide OH ⁻ | iodide I ⁻ | nitrate NO ₃ ⁻ | oxide O ²⁻ | phosphate PO ₄ ³⁻ | silicate SiO ₃ ²⁻ | sulfate SO ₄ ²⁻ | sulfide S ²⁻ | sulfite SO ₃ ²⁻ |
|---------------------------------------|---|-------------------------|---|--|--------------------------|---------------------------|-----------------------|--------------------------------------|-----------------------|---|---|---------------------------------------|-------------------------|---------------------------------------|
| aluminum Al ³⁺ | S | S | | S | S | I | S | S | I | I | I | S | D | |
| ammonium NH ₄ ⁺ | S | S | S | S | S | S | S | S | | S | | S | S | S |
| antimony Sb ³⁺ | | D | | | S | | D | | P | | | D | I | |
| arsenic As ³⁺ | | D | | | D | | S | | P | | | | I | |
| barium Ba ²⁺ | S | S | I | S | S | P | S | S | P | I | S | I | D | I |
| bismuth Bi ²⁺ | S | D | I | | D | I | I | D | I | I | | D | I | |
| cadmium Cd ²⁺ | S | S | I | S | S | I | S | S | I | I | I | S | I | P |
| calcium Ca ²⁺ | S | S | I | S | S | P | S | S | P | I | I | P | D | I |
| chromium (III) Cr ³⁺ | S | S | | | S | I | | S | I | P | | S | I | |
| cobalt (II) Co ²⁺ | | S | I | S | S | I | S | S | I | I | I | S | I | I |
| copper (II) Cu ²⁺ | S | S | I | S | S | I | | S | I | I | | S | I | |
| iron (II) Fe ²⁺ | S | S | I | | S | I | S | S | I | I | I | S | I | P |
| iron (III) Fe ³⁺ | | S | | | S | I | | S | I | I | | S | D | |
| hydrogen H ⁺ | S | S | | S | S | | S | S | | S | S | S | S | S |
| lithium Li ⁺ | S | S | S | S | S | S | S | S | S | S | S | S | S | S |
| Lead (II) Pb ²⁺ | S | P | I | S | P | I | P | S | I | I | I | I | I | I |
| magnesium Mg ²⁺ | S | S | I | S | S | I | S | S | I | P | I | S | D | P |
| mercury (I) Hg ⁺ | P | I | I | S | I | | I | S | I | I | | P | I | |
| mercury (II) Hg ²⁺ | S | P | I | S | P | I | I | S | I | I | | D | I | |
| nickel (II) Ni ²⁺ | S | S | I | S | S | I | S | S | I | I | | S | I | I |
| potassium K ⁺ | S | S | S | S | S | S | S | S | S | S | S | S | S | S |
| silver Ag ⁺ | P | I | I | S | I | | I | S | I | I | | P | I | P |
| sodium Na ⁺ | S | S | S | S | S | S | S | S | S | S | S | S | S | S |
| strontium Sr ²⁺ | S | S | I | S | S | P | S | S | P | I | I | P | D | I |
| zinc Zn ²⁺ | S | S | I | S | S | I | S | S | I | I | I | S | I | P |

1. All common ammonium, sodium and potassium compounds are soluble.
2. All common acetates, chlorates and nitrates are soluble.
3. All common chlorides are soluble except those of silver, mercury and lead. Lead chloride is slightly soluble in cold water, but highly soluble in hot water.
4. All common sulfates are soluble except those of barium and lead. Sulfates of calcium, strontium and silver are only slightly soluble.
5. All hydroxides are insoluble except those of ammonium, sodium and potassium. The hydroxides of barium, calcium and strontium are only slightly soluble.
6. Carbonates, phosphates, oxides, sulfides and sulfites are generally insoluble, except for those of ammonium, sodium and potassium.